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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/521,060	12/30/2004	Seiji Nakahata	039.0058	8583

29453 7590 01/26/2007  
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EXAMINER
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LE, THAO P

ART UNIT	PAPER NUMBER
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2818

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/26/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/521,060

Applicant(s)

NAKAHATA ET AL.

Examiner

Thao P. Le

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on 11/21/06.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 December 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

DETAILED ACTION

Claims 1-16 are pending in this application.

Remarks and amendments of application filed on 11/21/06 have been fully considered. The previous rejection has been withdrawn. Claims 1-16 are still rejected in view of new grounds of rejection as below.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**Claims 1, 3, 4, 5, 6, 8 are rejected under 35 USC 102 (b) as being anticipated by Usui et al., U.S. Publication No. 2002/0197825, hereinafter Usui.**

Regarding claim 1, Usui discloses a method of manufacturing a group III-V crystal, characterized in comprising: a step of depositing a metal film 3 on a substrate [0133]; a step of heat-treating the metal film under an atmosphere in which a patterning compound is present [0133], the pattern compound is present (hydrogen and ammonia) so that the metal film becomes patterned with a plurality of holes or grooves having an indefinite shape ([0034]; Fig. 12c); a step of growing a group III-V compound crystal 4 on the metal film (Fig. 12d). Note that the shape of the voids formed in metal film due to

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the heat-treating in Usui considered as indefinite because the shape of the voids in Usui is uncontrolled. The shape of the voids is formed from heat treatment without any pattern or mask. Therefore, voids in metal film can be formed of any shape.

Regarding claim 3, Usui discloses the method of claim 1, further discloses the depth of the voids is up to 500 nm and the surface area of the holes or grooves (voids) in the metal occupy with respect to the substrate total surface area is about 65 % which falls into the ranges disclosed in claim 3.

Regarding claim 4, Usui discloses the method of claim 1, characterized in that the substrate is sapphire (layer 1 or 2; abstract).

Regarding claim 5, Usui discloses the method of claim 1, characterized in that the metal film contains titanium (3, abstract).

Regarding claim 6, Usui discloses the method of claim 1, further discloses the thickness of the metal film is about 20 nm [0133] which falls into the range disclosed in claim 6.

Regarding claim 8, Usui discloses a group III-V compound crystal manufactured by a group III-V crystal manufacturing method as set forth in claim 1.

### **Claim Rejections - 35 USC § 103**

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a

whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over by Usui et al., U.S. Publication No. 2002/0197825, hereinafter Usui.**

Regarding claim 7, Usui discloses the method of claim 1, further discloses the heat treatment is carried out at 800-1200 oC for 30 minutes. Usui fails to disclose the duration of the heat treatment is from 05 to 20 minutes as recited in claim 7. However, the selection of the parameters such as **energy, concentration, temperature, time, molar fraction, depth, thickness, etc.**, would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art.

"Normally, it is to be expected that a change in **energy, concentration, temperature, time, molar fraction, depth, thickness, etc., or in combination of the parameters** would be an unpatentable modification. Under some circumstances; however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller* 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66

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*USPQ 308 (CCPA 1945); In re Swenson 56 USPQ 372 (CCPA 1942); In re Sola 25 USPQ 433 (CCPA 1935); In re Dreyfus 24 USPQ 52 (CCPA 1934).*

**Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over by Usui et al., U.S. Publication No. 2002/0197825, hereinafter Usui, in view of Nagai, EP 1378934, hereinafter Nagai.**

Regarding claim 9, Usui discloses the group III-V compound crystal as set forth in claim 8 wherein the group III-V crystal is GaN but fails to disclose the group III-V crystal is GaAlIn as recited in claim 9. However, Nagai discloses the group III-V compound crystal as set forth in claim 8, the III-V crystal being  $Ga_xAl_yIn_{1-x-y}$  [0001]. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use GaAlIn to reduce crystal defect density.

**Claims 2, 10-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over by Usui et al., U.S. Publication No. 2002/0197825, hereinafter Usui, in view of Nagai, EP 1378934, hereinafter Nagai.**

Regarding claim 2, Usui discloses a method of manufacturing a group III-V crystal, characterized in comprising: a step of depositing a metal film 3 on a substrate [0133]; a step of heat-treating the metal film under an atmosphere in which a patterning compound is present [0133], the pattern compound is present (hydrogen and ammonia)

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so that the metal film becomes patterned with a plurality of holes or grooves having an indefinite shape ([0034]; Fig. 12c); a step of growing a group III-V compound crystal 4 on the metal film (Fig. 12d). Note that the shape of the voids formed in metal film due to the heat-treating in Usui considered as indefinite because the shape of the voids in Usui is uncontrolled. The shape of the voids is formed from heat treatment without any pattern or mask. Therefore, voids in metal film can be formed of any shape.

Usui fails to disclose the step of growing a group III-V compound buffer film on the post-heat-treated metal before growing a group III-V crystal on the buffer film.

Nagai discloses a step of growing a group III-V buffer film 32 on the metal film (layer of group III-V compound GaN is grown in the layer 31, [0048]) and a step of growing a group III-V crystal 203 on the buffer film (Fig. 4) (See Figs. 1A-1H and third embodiment; [0056-0057]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to form a group III-V buffer film on the substrate before growing the group III-V crystal film because the growth of group III-V buffer film on the substrate before the growth of group III-V crystal can improve crystallinity of the group III-V crystal film and also relax misfit between the substrate and group III-V crystal film.

Regarding claim 10, Usui discloses the method of claim 2, further discloses the depth of the voids is up to 500 nm and the surface area of the holes or grooves (voids) in the metal occupy with respect to the substrate total surface area is about 65 % which falls into the ranges disclosed in claim 10.

Regarding claim 11, Usui discloses the method of claim 2, characterized in that the substrate is sapphire (layer 1 or 2; abstract).

Regarding claim 12, Usui discloses the method of claim 2, characterized in that the metal film contains titanium (3, abstract).

Regarding claim 13, Usui discloses the method of claim 2, further discloses the thickness of the metal film is about 20 nm [0133] which falls into the range disclosed in claim 13.

Regarding claim 14, Usui discloses the method of claim 2, further discloses the heat treatment is carried out at 800-1200 °C for 30 minutes. Usui fails to disclose the duration of the heat treatment is from 05 to 20 minutes as recited in claim 14. However, the selection of the parameters such as **energy, concentration, temperature, time, molar fraction, depth, thickness, etc.**, would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art.

"Normally, it is to be expected that a change in **energy, concentration, temperature, time, molar fraction, depth, thickness, etc.**, or in combination of the parameters would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller* 105 USPQ233,



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255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Regarding claim 15, Usui discloses a group III-V compound crystal manufactured by a group III-V crystal manufacturing method as set forth in claim 2.

Regarding claim 16, Usui discloses the group III-V compound crystal as set forth in claim 15 wherein the group III-V crystal is GaN but fails to disclose the group III-V crystal is GaAlIn as recited in claim 16. However, Nagai discloses the III-V crystal is  $\text{Ga}_x\text{Al}_y\text{In}_{1-x-y}$  [0001]. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use GaAlIn to reduce crystal defect density.

When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao P. Le whose telephone number is 571-272-1785. The examiner can normally be reached on M-T (7-6).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David C. Nelms can be reached on 571-272-1787. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Thao P. Le', with a stylized, flowing script.

Thao P. Le  
Primary Examiner  
Art Unit 2818  
January 20, 2007.